Commercial Standard CS201-55

Rigid Polyvinyl Chloride Sheets

A RECORDED VOLUNTARY STANDARD OF THE TRADE

COMMODITY STANDARDS

Simplified Practice Recommendations and Commercial Standards are developed by manufacturers, distributors, and users in cooperation with the Commodity Standards Division of the Office of Technical Services, and with the National Bureau of Standards.

The purpose of Simplified Practice Recommendations is to eliminate avoidable waste through the establishment of standards of practice for stock sizes and varieties of specific commodities that currently are in general production and demand. The purpose of Commercial Standards is to establish standard methods of test, rating, certification, and labeling of commodities, and to provide uniform bases for fair competition.

The adoption and use of a Simplified Practice Recommendation or a Commercial Standard is voluntary. However, when reference to a Commercial Standard is made in contracts, labels, invoices, or advertising literature, the provisions of the standard are enforcible through usual legal channels as a part of the sales contract.

A Simplified Practice Recommendation or a Commercial Standard originates with the proponent industry. The sponsors may be manufacturers, distributors, or users of the specific product. One of these three elements of industry submits to the Commodity Standards Division the necessary data to be used as the basis for developing a standard of practice. The Division, by means of assembled conferences or letter referenda, or both, assists the sponsor group in arriving at a tentative standard of practice and thereafter refers it to the other elements of the same industry for approval or for constructive criticism that will be helpful in making any necessary adjustments. The regular procedure of the Division assures continuous servicing of each effective Simplified Practice Recommendation and Commercial Standard, through review and revision, whenever, in the opinion of the industry, changing conditions warrant such action.

UNITED STATES DEPARTMENT OF COMMERCE

Sinclair Weeks, Secretary

U. S. DEPARTMENT OF COMMERCE

SINCLAIR WEEKS, Secretary

Prepared by

OFFICE OF TECHNICAL SERVICES

Commodity Standards Division

In cooperation with

NATIONAL BUREAU OF STANDARDS

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Rigid Polyvinyl Chloride Sheets

[Effective December 15, 1955]

1. PURPOSE

1.1 The purpose of this Commercial Standard is to provide a nationally recognized specification for the guidance of producers, distributors, testing laboratories, and users of rigid polyvinyl chloride plastic sheets; to promote fair competition between sellers; and to maintain confidence in the quality of the products of the industry.

2. SCOPE

2.1 This Commercial Standard covers physical and chemical requirements, and methods of test for rigid polyvinyl chloride plastic sheets suitable for fabricating equipment and structures by hot-forming and plastic welding techniques. The chief characteristics of rigid polyvinyl chloride plastics are thermoplasticity, toughness, resistance to water and chemicals, and dimensional stability. They are suitable only for applications involving relatively low loads and operating temperatures. A recommended method of declaring compliance with the standard is included.

3. TYPES

3.1 This Commercial Standard includes requirements for two types of rigid polyvinyl chloride plastic sheets:

Type I.—Chemical resistant, normal impact.
Type II.—Chemical resistant, high impact.

4. REQUIREMENTS

4.1 *Material.*—The sheets shall be made of rigid vinyl chloride polymer and/or copolymer resins and any necessary stabilizers and lubricants, with or without the addition of dyes, pigments, and fillers.

4.2 *Dimensions.*—The size, normal thickness, and dimensional tolerances of the sheets shall be as specified in the contract or purchase order. Unless otherwise specified in the contract or purchase order, the tolerance on length and width shall be plus ⅛ inch and minus 0 inch, and the tolerance on thickness shall be ±10 percent of the specified thickness.

4.3 *Color and transparency.*—The color and transparency or opacity of the sheets shall be as specified in the contract or purchase order.

4.4 *Finish.*—The sheets shall be furnished with a high-polish finish, a matte finish, or a special finish, as specified in the contract or purchase order.

4.5 *Uniformity.*—The sheets shall be uniform in color, transparency or opacity, finish, density, and other physical properties.

4.6 *Physical requirements.*—Test specimens cut from the sheets shall conform to the applicable physical requirements for the type as shown in table 1, when tested in accordance with section 6.

TABLE 1. *Physical requirements for rigid polyvinyl chloride plastic sheets*

Item	Type I	Type II
Tensile strength,[1] min., psi	7,000	5,000
Flexural strength,[1] min., psi	11,000	8,500
Modulus of elasticity in flexure,[1] min., psi	400,000	300,000
Impact strength, Izod,[1] min., ft-lb per inch of notch	0.5	3.0
Heat distortion temperature,[1] at 264 psi fiber stress, min.:		
deg. Centigrade	70	66
deg. Fahrenheit	158	150
Hardness,[1] Rockwell (R scale), min	110	100

[1] Specimens conditioned at 23° C (73.4° F) and 50 percent relative humidity: ⅛ in. or thinner for 48 hours; thicker specimens for 96 hours.

4.7 *Chemical resistance.*—When tested in accordance with paragraph 6.9, the chemical resistance of test specimens cut from the sheets shall conform to the applicable chemical requirements for the type as shown in table 2.

TABLE 2. *Allowable changes in physical properties of rigid polyvinyl plastic sheets after immersion in chemicals*

Item		Type I	Type II
After immersion in 80-percent sulfuric acid:			
Change in weight, percent	increase	5	15
	decrease	5	0
Change in flexural strength, percent	increase	15	25
	decrease	15	25
After immersion in 100 percent acetic acid:			
Change in weight, percent	increase	10	20
	decrease	0	0
Change in flexural strength, percent	increase	0	0
	decrease	55	80

4.8 *Delamination.*—Shapes of laminated rigid polyvinyl chloride shall show no evidence of delamination or disintegration after immersion in acetone in accordance with paragraph 6.10. Evidence of softening and/or swelling shall not constitute failure.

4.9 *Workmanship.*—The sheets shall be free from warpage, cracks, scratches, and other defects which affect the appearance or which might affect the serviceability.

5. SAMPLING, INSPECTION, AND ACCEPTANCE CONDITIONS

5.1 *Sampling.*—A sample [1] of the sheets sufficient to determine conformance of the material with these specifications shall be taken at random from each lot of material or 1 day's production, whichever is the lesser. If the sheets are of such shape and thickness that the necessary test specimens cannot be obtained from them, a sheet ⅛ in. in thickness, prepared from the same plastic composition under as nearly similar production conditions as possible, and sufficient to determine conformance of the material with these specifications, may be tested to determine compliance with this Commercial Standard.

[1] An area of about 5 sq. ft. is required to make the tests on thin materials; a little less on thicker stock.

5.2 *Inspection.*—The samples of sheets shall be inspected for type of material, dimensions, color, finish uniformity, optical defects, and workmanship, to determine compliance with these specifications. Inspection shall also include packaging, packing, and marking for shipment.

5.3 *Number of specimens.*—One set of test specimens as prescribed in the test methods shall be considered sufficient for testing each lot of sheets. The average result for the specimens tested shall conform to the requirements prescribed in these specifications.

5.4 *Plastic material evaluation.*—Tests for all the requirements listed in tables 1 and 2 and in paragraph 6.10 shall be made to establish conformity of a material to this standard. In the normal course of manufacture, these tests will generally be made by the manufacturer. It is not always necessary that all these tests be repeated to determine compliance of each lot of a material previously tested and found to comply with this standard.

5.5 *Acceptance tests.*—Acceptance tests to determine compliance of each lot of a material previously tested and found to comply with this standard may be limited to those required to identify the material. These tests shall be impact strength (Izod), chemical resistance (weight change only), and delamination in case of laminated shapes. However, any of the other tests described in this standard may be made on any or all lots to determine that the material meets the requirements of this standard.

5.6 *Retest and rejection.*—If the results of any test do not conform to the requirements prescribed in this standard, the tests shall be repeated on two additional sets of specimens from the same lot, each of which shall conform to the requirements specified. If either of these two additional sets of specimens fails, the material does not comply with this Commercial Standard.

6. METHODS OF TEST

6.1 *Conditioning test specimens.*—For those tests where conditioning is required, the test specimens shall be conditioned in accordance with procedure A of the Standard Method of Conditioning Plastics and Electrical Insulating Materials for Testing (ASTM Designation D 618).

6.2 *Test conditions.*—Tests shall be conducted in the standard laboratory atmosphere of 23° ±1° C (73.4° ±2° F) and 50 percent ±2 percent relative humidity, unless otherwise specified in the testing methods or in these specifications.

6.3 *Tensile strength.*—Tentative Method of Test for Tensile Properties of Plastics (ASTM Designation D 638).

6.4 *Flexural strength.*—Tentative Method of Test for Flexural Properties of Plastics (ASTM Designation D 790).

6.5 *Modulus of elasticity in flexure.*—Tentative Method of Test for Flexural Properties of Plastics (ASTM Designation D 790).

6.6 *Impact strength (Izod).*—Method A of the Tentative Methods of Test for Impact Resistance of Plastics and Electrical Insulating Materials (ASTM Designation D 256). The test specimen shall have a milled notch.

6.7 *Heat distortion temperature.*—Tentative Method of Test for Heat Distortion Temperature of Plastics (ASTM Designation D 648), using a fiber stress of 264 psi.

6.8 *Rockwell hardness.*—Method A of the Standard Method of Test for Rockwell Hardness of Plastics and Electrical Insulating Materials (ASTM Designation D 785).

6.9 *Resistance to chemical reagents.*—Tentative Method of Test for Resistance of Plastics to Chemical Reagents (ASTM Designation D 543), using as reagents 80-percent sulfuric acid and 100-percent glacial acetic acid and the following modifications: The sample shall be immersed at a temperature of 140° F for 30 days, followed by conditioning in the reagent for 1 day at 23° ±1° C (73.4° ±2° F). Flexural strength and weight change shall be measured before and after immersion.

6.10 *Delamination.*—Three specimens of each sample of laminated shapes at least 1 inch wide shall be placed in separate containers, and totally immersed in anhydrous liquid acetone for at least 2 hours, or for a period specified in the contract or purchase order, at 23° ±1° C (73.4° ±2° F). The specimen shall be placed on edge in the container so that it is supported at an angle by the bottom and side wall of the container.

7. PACKING AND MARKING

7.1 *Packing.*—The material shall be packed in standard commercial containers, so constructed as to insure acceptance by common or other carriers for safe transportation at the lowest rate to the point of delivery in the contract or order.

7.2 *Marking.*—Shipping containers shall be marked with the name, stock number, and surface finish of the material, the size and quantity therein as defined by the contract or order under which shipment is made, the name of the manufacturer, and the number of the contract or order.

8. DECLARATION OF COMPLIANCE

8.1 In order that purchasers may be assured that rigid polyvinyl chloride plastic sheets purchased actually comply with all requirements of this Commercial Standard, it is recommended that manufacturers include the following statement in conjunction with their name and address on labels, invoices, sales literature, etc.:

> These rigid polyvinyl chloride plastic sheets comply with Commercial Standard CS201–55, as developed by the trade under the procedure of the Commodity Standards Division, and issued by the U. S. Department of Commerce.

9. EFFECTIVE DATE

9.1 Having been passed through the regular procedure of the Commodity Standards Division, and approved by the acceptors hereinafter listed, this Commercial Standard was issued by the United States Department of Commerce, effective from December 15, 1955.

EDWIN W. ELY,
Chief, Commodity Standards Division.

HISTORY OF PROJECT

Under date of January 21, 1955, the Society of the Plastics Industry, Inc., requested the cooperation of the Commodity Standards Division in the establishment of a Commercial Standard for rigid polyvinyl

chloride sheets, and submitted the draft of a proposed standard developed by the Thermoplastic Structures Division of the Society.

The above-mentioned draft was referred by the Commodity Standards Division to a representative list of producers, distributors, and users for consideration and comment, during the month of February. The comments received were reported to the Society of the Plastics Industry, and the proposed Commercial Standard was modified in accordance with the consensus of comment. On August 26, 1955, the draft as modified was circulated to the entire industry for written acceptance.

Acceptances having been received estimated to represent a satisfactory volume of the current production, the establishment of the Commercial Standard, designated CS201–55, was announced on November 15, to become effective December 15, 1955.

Project Manager: F. W. Reynolds, Commodity Standards Division, Office of Technical Services.

Technical Adviser: Frank W. Reinhart, Organic Plastics Section, Organic and Fibrous Materials Division, National Bureau of Standards.

STANDING COMMITTEE

The following individuals comprise the membership of the standing committee, which is to review, prior to circulation for acceptance, revisions proposed to keep the standard abreast of progress. Comment concerning the standard and suggestions for revision may be addressed to any member of the committee or to the Commodity Standards Division, Office of Technical Services, United States Department of Commerce, which acts as secretary for the committee.

VERNON PIERCE, *Chairman*

WILLIAM P. ELWELL, H. N. Hartwell & Son, Inc., Park Square Building, Boston 16, Mass.

CARL FIGENSCHER, Seiberling Rubber Co., Akron, Ohio

CARL HEIL, Heil Process Equipment Corp., 12901 Elmwood Ave., Cleveland 11, Ohio

C. R. OWEN, Colonial Plastics Manufacturing Co., 8007 Grand Ave., Cleveland, Ohio

VERNON PIERCE, Kaykor Industries, Inc., Yardville, N. J.

GEORGE REED, American Hard Rubber Co., 93 Worth St., New York 13, N. Y.

IRVING SCHMITT, Masland Duraleather Co., Amber and Willard Sts., Philadelphia, Pa.

D. SKOWLUND, B. F. Goodrich Co., Akron, Ohio

ROLAND TRUDEAU, D & R Plastic Welders, Inc., P. O. Box J, Hazardville, Conn

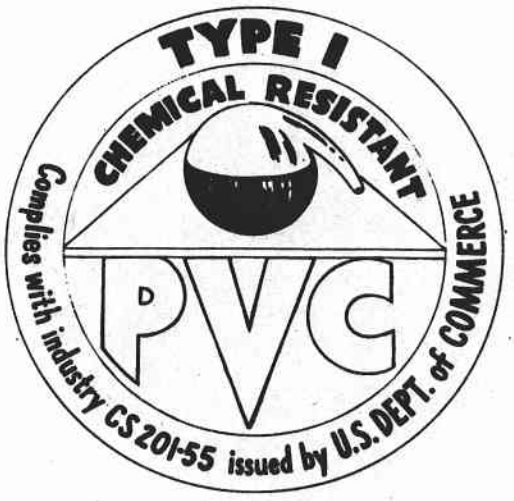
RIGID POLYVINYL CHLORIDE SHEETS

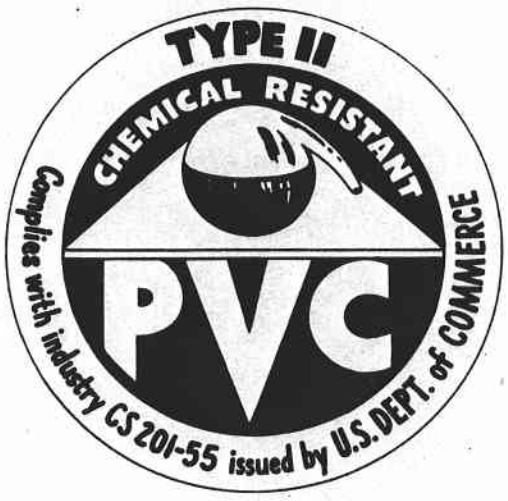
Commercial Standard CS201-55

Amendment No. 1

April 2, 1956

The Society of the Plastics Industry, Inc., has adopted the hallmarks shown below for the use of manufacturers in identifying products conforming to Commercial Standard CS 201-55.





CS201-55

ACCEPTANCE OF COMMERCIAL STANDARD

If acceptance has not previously been filed, this sheet properly filled in, signed, and returned will provide for the recording of your organization as an acceptor of this Commercial Standard.

Date_____

Commodity Standards Division,
Office of Technical Services,
U. S. Department of Commerce,
Washington 25, D. C.

Gentlemen:

We believe that this Commercial Standard constitutes a useful standard of practice, and we individually plan to utilize it as far as practicable in the

production [1] distribution [1] purchase [1] testing [1]

of rigid polyvinyl chloride sheets.

We reserve the right to depart from the standard as we deem advisable.

We understand, of course, that only those products which actually comply with the standard in all respects can be identified or labeled as conforming thereto.

(Cut on this line)

Signature of authorized officer_____
(In ink)

(Kindly typewrite or print the following lines)

Name and title of above officer_____

Organization_____
(Fill in exactly as it should be listed)

Street address_____

City, zone, and State_____

[1] Underscore the one that applies. Please see that separate acceptances are filed for all subsidiary companies and affiliates which should be listed separately as acceptors. In the case of related interests, trade associations, trade papers, etc., desiring to record their general support, the words "General Support" should be added after the signature.

TO THE ACCEPTOR

The following statements answer the usual questions arising in connection with the acceptance and its significance:

1. *Enforcement.*—Commercial Standards are commodity specifications voluntarily established by mutual consent of those concerned. They present a common basis of understanding between the producer, distributor, and consumer and should not be confused with any plan of governmental regulation or control. The United States Department of Commerce has no regulatory power in the enforcement of their provisions, but since they represent the will of the interested groups as a whole, their provisions through usage soon become established as trade customs, and are made effective through incorporation into sales contracts by means of labels, invoices, and the like.

2. *The acceptor's responsibility.*—The purpose of Commercial Standards is to establish, for specific commodities, nationally recog nized grades or consumer criteria, and the benefits therefrom will be measurable in direct proportion to their general recognition and actual use. Instances will occur when it may be necessary to deviate from the standard and the signing of an acceptance does not preclude such departures; however, such signature indicates an intention to follow the standard, where practicable, in the production, distribution, or consumption of the article in question.

3. *The Department's responsibility.*—The major function performed by the Department of Commerce in the voluntary establishment of Commercial Standards on a nationwide basis is fourfold: first, to act as an unbiased coordinator to bring all interested parties together for the mutually satisfactory adjustment of trade standards; second, to supply such assistance and advice as past experience with similar programs may suggest; third, to canvass and record the extent of acceptance and adherence to the standard on the part of producers, distributors, and users; and fourth, after acceptance, to publish and promulgate the standard for the information and guidance of buyers and sellers of the commodity.

4. *Announcement and promulgation.*—When the standard has been endorsed by a satisfactory majority of production or consumption in the absence of active valid opposition, the success of the project is announced. If, however, in the opinion of the standing committee or of the Department of Commerce, the support of any standard is inadequate, the right is reserved to withhold promulgation and publication.

ACCEPTORS

The organizations listed below have individually accepted this standard for use as far as practicable in the production, distribution, testing, purchase, or use of rigid polyvinyl chloride sheets. In accepting this standard they reserved the right to depart from it as they individually deem advisable. It is expected that articles which actually comply with the requirements of this standard in all respects will be regularly identified or labeled as conforming thereto, and that purchasers will require such specific evidence of conformity.

ASSOCIATIONS

(General Support)

American Society for Testing Materials, Philadelphia, Pa.

FIRMS

Acadia Synthetic Products Division of Western Felt Works, Chicago, Ill.
Alpha Plastics, Inc., West Orange, N. J.
American Agile Corp., Maple Heights, Ohio.
American Hard Rubber Co., New York, N. Y.
Atlas Mineral Products Co., Mertztown, Pa.
Auburn Button Works, Inc., Auburn, N. Y.
Bakelite Co., Division of Union Carbide & Carbon Corp., New York, N. Y.
Bolta Products, Division of General Tire & Rubber Co., Lawrence, Mass.
Cadet Chemical Corp., Burt, N. Y.
Comco, Inc., New Haven, Conn.
D & R Plastic Welders, Inc., Hazardville, Conn.
Dow Chemical Co., Midland, Mich.
Firestone Plastics Co., Pottstown, Pa.
Goodrich, B. F., Co., Marietta, Ohio.
Goodrich, B. F., Chemical Co., Cleveland, Ohio
Goodyear Tire & Rubber Co., Inc., Chemical Division, Akron, Ohio
Hartwell, H. N., & Son, Inc., Boston, Mass.
Haveg Corp., Wilmington, Del.
Heil Process Equipment Corp., Cleveland, Ohio
Industrial Plastic Fabricators, Inc., Norwood, Mass.
Kaye-Tex Manufacturing Co., Yardville, N. J.
Kaykor Industries, Inc., Yardville, N. J.
Macy, R. H., & Co., Inc., New York, N. Y.
Masland Duraleather Co., Philadelphia, Pa.
Missouri Pacific Lines, St. Louis, Mo.
Monsanto Chemical Co., Springfield, Mass.
Mosites, G. A. Co., Houston, Tex.
Nixon Nitration Works, Nixon, N. J.
Plastichem, Inc., Hawthorne, N. J.
Respro, Inc., Cranston, R. I.
Seiberling Rubber Co., Plastics Division, Newcomerstown, Ohio
Solvay Process Division, Allied Chemical & Dye Corp., Syracuse, N. Y.
Van Dorn Iron Works Co., Cleveland, Ohio
Westinghouse Electric Corp., East Pittsburgh, Pa.

U. S. GOVERNMENT

Department of the Army, Deputy Chief of Staff for Logistics, Washington, D. C.

OTHER COMMERCIAL STANDARDS

A list of all effective Commercial Standards may be obtained from the Commodity Standards Division, Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. These publications may be purchased at the prices indicated on the list, which also includes directions for ordering copies.

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